under 35 U.S.C. § 103(a). Applicants submit concurrently herewith a comparison of the polishing performance of a dispersion meeting the present claim limitations with the polishing performance of a slurry disclosed in Ronay (U.S. 5,876,490). The submission attached herewith includes the Japanese Experiment Report of one of the presently named inventors (Hattori Masayuki) together with a verified English language translation.

In order to demonstrate the superiority of the presently claimed process in view of the process disclosed by Ronay, Applicants have provided a comparison of the polishing rates achievable with the presently claimed invention in comparison with the polishing rates achievable with the Ronay slurry. As stated in the English language translation of the Experiment Report, the comparison is a direct comparison of a dispersion meeting the present claim limitations with a dispersion disclosed in Ronay. Measurements were taken under the same conditions. The results of the experiment, as disclosed in the attached Experiment Report and verified English translation thereof, are summarized in the Table below.

	Polishing Rate	No. of Scratches
Present dispersion Example 2A (Sp/Si = 1.3)	3,900 Å/min	≤ 30 pt.
Ronay slurry	410 Å/min	≥ 200 pts.
Alumina Particles (no polymer present)	1,900 Å/min	85 pts.

As is evident from the results of the Experiment report tabulated above, the polishing rate achievable with the presently claimed invention is 3,900 Å/min whereas the polishing rate achieved with the slurry disclosed in the Ronay patent is only 410 Å/min. Moreover, the quality of the polished surface is improved when the presently claimed dispersion is used. As is shown in the last column of the Table above, the surface polished with the presently

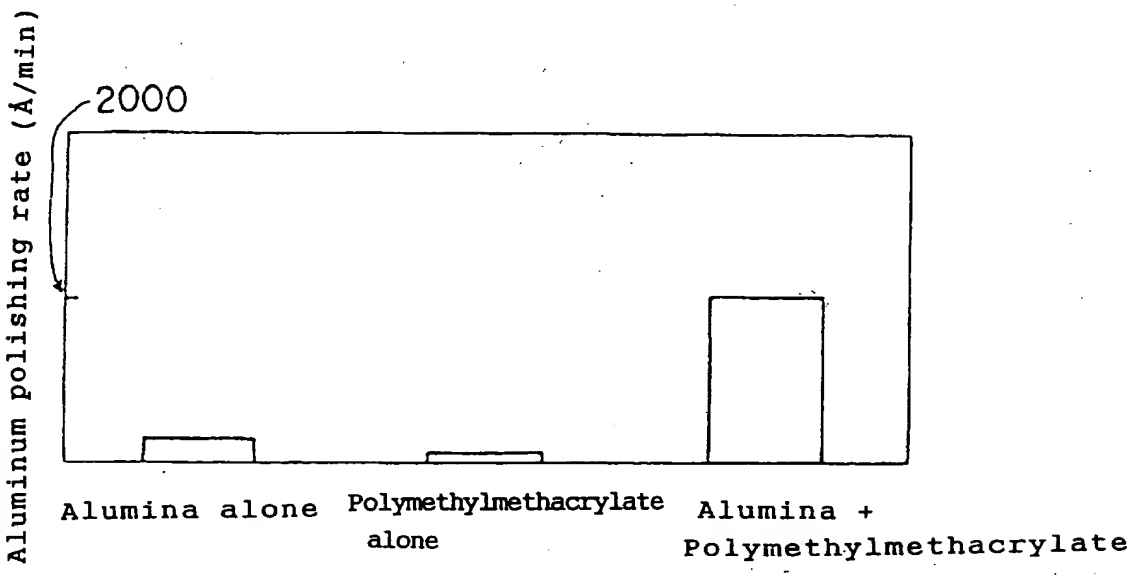
claimed method exhibited a lower number of scratches (less than 30 pts. v. more than 200 pts. in Ronay).

The Ronay patent discloses a polishing slurry wherein an abrasive particle is coated with a polyelectrolyte (polymer). The present application claims a different invention, namely a mixture of polymer particles and inorganic particles wherein a plurality of inorganic particles are attached to the surface of each polymer particle and a ratio of the mean particle size of the polymer particle and the mean particle size of the inorganic particles (Sp/Si) is from 1 to 40. The presently claimed invention requires one or more inorganic particles to be attached to each polymer particle whereas in the prior art relied upon by the Examiner the inorganic particle is described as being coated by the polymer particle. This difference is reflected in the drawings. Prior art Figure 3 and present Figure 8 are reproduced as Appendix 1 (attached as the last page). In prior art Figure 3 the inorganic particle (dark spot) is depicted as being surrounded by a layer of polymer particle. In contrast, present Figure 8 clearly shows that a plurality of inorganic (small) particles are attached to the polymer (large) particle.

The presently claimed aqueous dispersion is disclosed to provide significantly increased polishing rates. The present specification discloses that the polishing rates achieved with mixtures of inorganic particles and polymer particles are significantly greater than the cumulative polishing rates of the inorganic particles or the polymer particles individually. For example, Embodiment 1E (page 48, line 14 - page 49, line 9) compares the polishing rates achieved with each of (1) a dispersion meeting the present claim limitations, (2) a dispersion containing only the polymer particle and (3) a dispersion containing only alumina particles. As is shown in Figure 6 (reproduced below for convenience) the polishing rate achieved with a dispersion containing a combination of the polymer particles and

alumina particles is significantly greater than the cumulative effect of the polishing rate of the individual particles.

Fig. 6



Moreover, the patent discloses that the combination of polymer and abrasive particles yields a reduced polishing rate. The Ronay patent states that polymer-coated abrasive particles have reduced polishing rates:

> "Among the aspects recognized by the present inventor about *polymer-coated abrasive particles* are the following:
>
> > 1. *Their polishing action is greatly reduced. Which results in diminishing polishing rates.*

(column 3, lines 49-54; italics added).

The disclosure of the Ronay patent therefore does not suggest that significantly improved polishing rates can be achieved by combining a plurality of inorganic particles with a polymer particle and, in fact, expressly teaches that reduced polishing rates are expected.

Applicants submit that the Ronay patent cannot render the presently claimed invention obvious in view of (i) the Japanese Experiment Report and verified English translation thereof submitted herewith providing a direct comparison between the claimed dispersions and the prior art slurry showing the improved polishing rate for the presently claimed composition and (ii) the contradictory disclosure of the Ronay patent.

Applicants submit the presently claimed invention is not obvious over the prior art relied upon by the Examiner. Applicants respectfully request the withdrawal of the outstanding rejections and the passage of all now pending claims to Issue.

Respectfully submitted,

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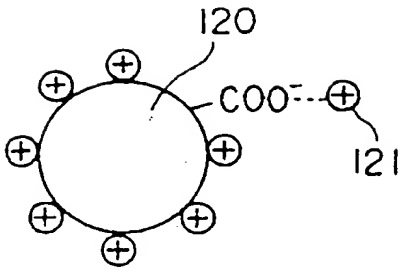
APPENDIX 1

Fig. 8



⊙ Polyion-coated abrasive particle

• Uncoated abrasive particle

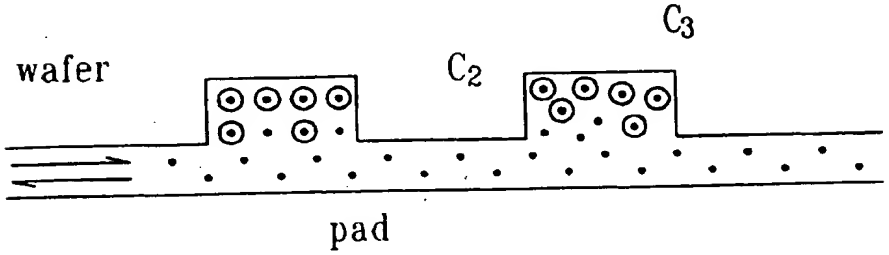


FIG. 3

Received at: 7:50AM, 9/20/2002

VERIFICATION

I, Seiji KOJIMA

Kojima International Patent Office
ATSUTA DAIDOSEIMEI-Bldg.2F,
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Nagoya-shi, Aichi,
456-0031,Japan

verify that to the best of my knowledge and belief the following is a true English translation made by me of Japanese Experiment Report (Report date: September 11, 2002, Experiment Reporter: Masayuki Hattori).

Dated this 20th day of September 2002

Seiji Kojima

Received at: 7:50AM, 9/20/2002

Experiment Report

Experiment reporter: Masayuki Hattori

c/o: JSR Corporation

Speciality Material Laboratory

Fine Electronics Research Laboratories

Experiment date: September 3 ~ 7, 2002

Experimental place:

JSR Corporation, Speciality Material Laboratory

Fine Electronics Research Laboratories

Report date: September 11, 2002

Received at: 7:50AM, 9/20/2002

A report of Experimental Examples Effect

1. Preparation of aqeous dispersion for polishing.

(1) Sulury by JSR method (as described in Example 2A of the present application)

Water dispersion for polishing is prepared by blending a polymer particle (b) (crosslinked polymethyl methacrylate-based particle having carboxyl group, amide group, ester group on the surface of the particle and 0.17μm in mean particle diameter) 0.7% and a fumed alumina particle 5% into an ion-exchanged water. The pH value was adjusted to 4 with nitric acid. The zeta potential of the polymer particle (b) was indicated as -24 mV, and the zeta potential of the alumina particle was indicated as +35 mV.

As a result of observing it by a transmission electron microscope, it revealed that it became an aggregated particle having 1 - 10μm in mean particle diameter. Observing it in detail, the structure of alumina attached to the surface of the polymer particle (b) was observed. By checking them in detail, it became an aggregated particle measuring 1-10μm in diameter.

(2) Sulury by Ronay method (comparative experimental example).

An aqeous dispersion for polishing was prepared by blending polyacrylic acid (molecular weight 7000) 1.5% and fumed alumina particle 5% into an ion-exchanged water.

The polyacrylic acid is absorbed on the surface of the alumina particle, the alumina particle was dispersed into water made in a finer state. When observing it by a transmission electron microscope, its mean particle diameter was 130 nm.

(3) comparative example.

Slurry was prepared at pH 4 by adding alumina 5% without using the additive agent(polyacrylic acid). In this

case, the mean particle diameter was 150 nm.

2. Method of test

An aluminum film (film thickness 5000Å, containing 1% copper) attached to the thermally oxidized film of 8 inches, as polished in Experimental Example 2C of the present application was polished using the above-described three kinds of slurries under the same conditions. As for the method, a wafer was set in a CMP apparatus (Model "LPG510"; made by Lapmaster SFT, Corporation), IC1000 was used as a pad, 300g/cm2 was loaded and the wafer was polished for 1 minute under the conditions of the head/table at the speed of 125 rpm/120rpm and the slurry discharge at 250 ml/min.

3. The results of test

By the JSR method, the polishing rate was 3900Å/min. and the number of scratches was 30 points or less, hence the results were excellent.

On the other hand, in the Comparative Experiment Example utilizing a slurry according to Ronary method, since alumina was finely dispersed, the polishing rate was 410Å/min., specifically, extremely lowered. Moreover, since there is no suitable cushion effect, the number of the scratches was 200 points or more, and the scratches were found in the whole of the wafer.

For reference purpose of comparison. Slurry was prepared at pH 4 by adding alumina 5% without using the additive agent. In this case, it was found that the mean particle diameter was 150 nm, the polishing rate was 1900Å/min. and the number of the scratches was 85 points.

実験報告書

実験報告者；
ジェイエスアール株式会社
精密電子研究所　機能材料開発室
服部雅幸

実験日；２００２年９月３日～７日

実験場所；
ジェイエスアール株式会社
精密電子研究所　機能材料開発室内

報告日；２００２年９月１２日

実験結果報告

１．研磨用水分散体の調製

（１）ＪＳＲ法のスラリー（本願の実施例２Ａで記載の通りである。）

イオン交換水に重合体粒子（ｂ）（粒子表面にカルボキシル基、アミド基、エステル基を有し、平均粒子径０．１７μｍの架橋ポリメチルメタクリレート系粒子）０．７％、およびヒユームド法アルミナ粒子５％を配合して研磨用水分散体を調整した。ｐＨは硝酸でｐＨ＝４となるように調整した。重合体粒子（ｂ）のゼータ電位は－２４ｍＶ、アルミナ粒子のゼータ電位は＋３５ｍＶであった。

透過型電子顕微鏡で観察した結果、この分散粒子は、平均粒子径が１～１０μｍの凝集体となっていた。これを詳細に観察すると、重合体粒子（ｂ）の表面にアルミナが付着している構造であり、これらが更に緩やかに凝集して１～１０μｍになっていました。

（２）Ronay の方法により得られたスラリー（比較実験例）

イオン交換水にポリアクリル酸（分子量７０００）１．５％、およびヒユームド法アルミナ粒子５％を配合して研磨用水分散体を調製した。

この分散体は、アルミナ粒子表面にポリアクリル酸が吸着して、アルミナ粒子は微粒子に細かく水中に分散されており、透過型電子顕微鏡で観察した結果、平均粒子径は１３０ｎｍでした。

（３）比較参考例

比較の参考のため、添加剤（ポリアクリル酸）を使用しないで、上記アルミナ粒子５％でｐＨ＝４に調整したスラリーの場合は、粒子径は１５０ｎｍであった。

２．試験方法

上記３種類のスラリーを用いて、本願の実験例２Ｃで研磨したような、８インチの熱酸化膜上につけたアルミ膜（膜厚５０００オングストローム、１％の銅を含有する。）を同一条件で研磨した。方法はＣＭＰ装置（ラップマスターＳＦＴ社製　型式ＬＰＧ５１０）にウエーハをセット

して、パッドとしてＩＣ１０００を用いて、荷重３００ｇ／ｃｍ2になるようにして、ヘッドとテーブルの回転数を１２５／１２０ｒｐｍ、スラリー流量２５０ｍｌ／ｍｉｎとなる条件で１分間研磨した。

３．試験結果

結果は下記の通りとなった。

ＪＳＲ法では、研磨レートは３９００オングストローム／ｍｉｎ、スクラッチの数は３０個以下であり良好であった。

一方、Ronay の方法によるスラリーを用いた比較実験例では、アルミナが細かく分散されたため、研磨レートは４１０オングストローム／ｍｉｎとなり極端に低下した。また適度なクッション効果がないため、スクラッチも２００個以上とウエーハ全面にスクラッチが入ってしまった。

比較の参考のため、添加剤を使用しないで、アルミナ５％でｐＨ＝４に調整したスラリーの場合は、粒子径は１５０ｎｍであり、研磨レート１９００オングストローム／ｍｉｎでスクラッチ数は８５個であった。

以上